

CATARACT AND GLAUCOMA

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Cataract & Glaucoma

**hope
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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

National Institutes of Health

*If you confuse cataract and
glaucoma—read pages 3–10.*

*For the facts about cataract and
cataract research—read pages 11–18.*

*For the facts about glaucoma and
glaucoma research—read pages 19–28.*

*Where you can find help—
see pages 29–31.*

Cataract & Glaucoma

hope through research

"I missed you last month at our group lunch," a friend said to a businessman, Mr. Larkin. "Have you been on a vacation?"

"Well, sort of," Mr. Larkin answered. "I had a cataract operation."

"You did? And back to work so soon?"

"Of course. Cataract is a safe and common operation today. I was back on my feet in short order, although a few patients have a harder time than I did."

"But I didn't notice anything wrong with your eyes."

"My ophthalmologist recommended a fairly early operation, because my job requires reading such quantities of reports," Mr. Larkin explained. "This eye specialist said if I didn't have to read so constantly on the job I probably wouldn't have needed the operation for years. But since my cloudy lens interfered with my reading, he removed the lens. I'll use either a contact lens or special glasses which have the clearness my own lens lost with cataract."

Many people who notice difficulty with their eyes are wise enough to go promptly to an eye specialist. But an estimated million persons in the United States have a serious eye ailment without noticing any trouble. Mr. Page, for example, was having his eyes checked for reading glasses, and his ophthalmologist did

a painless little test with a small instrument called a tonometer, which measures internal eye pressure.

"Your eye pressure is too high," the eye specialist said. "Let me make a few other painless tests, and then we'll talk about it."

Soon the eye doctor explained that Mr. Page had a common ailment called glaucoma. "Luckily, you haven't lost any vision, and if you will be faithful for the rest of your life in using the eye drops I'm going to prescribe, we probably can reduce your eye pressure and keep it low enough to save your sight. But you'll be like the diabetic who has to take insulin all his life; you can't stop using your eye drops or you could lose your sight permanently."

Quite unfortunate, on the contrary, was gentle Mrs. Conroy. She did notice a lot of trouble with her eyesight, but she made a bad guess that she had cataracts. She made another bad guess that all people have to wait for cataracts to "ripen."

She finally went to an eye specialist and said, "My eyes are getting so bad I can hardly see. Am I ready for my cataract operation?"

After examining her eyes, her eye specialist had to explain, as kindly as possible, that she had glaucoma, not cataract, and that prolonged high eye pressure had killed many nerve fibers



in her eyes. She never would be able to regain her lost eyesight. Yet earlier attention such as Mr. Page received could have saved all or most of her vision.

In spite of warnings against self-doctoring, a few people every year confuse the two commonest causes of blindness in America—the temporary blindness of advanced cataract and the permanent blindness of neglected glaucoma.

Centuries of confusion

Cataract and glaucoma are separate ailments, but for centuries their distinction was not recognized, even by the famous Greek father of modern medicine, Hippocrates, who was born about 460 B.C. He used the word *glaucoma* which combines the Greek terms for “gray-greenish” and “diseased condition,” to describe any eye disorder in which the normally black pupil of the eye appears grayish. This includes the advanced stages both of glaucoma when the pupil is dilated and of cataract. Finally, in 1709, a French ophthalmologist defined glaucoma.

These 21 centuries of confusion could have a happy outcome today, because both these eye ailments can be treated to prevent blindness. Yet thousands in the United States go blind unnecessarily every year. Thousands more will become blind unless they learn about the advantages of regular eye checkups and carry out their eye specialist's advice faithfully.

Safe help for eyesight

Don't try to save your eyesight with eye drops which are advertised, or prescribed for a friend of yours. One man's sight-saving drops could cause another man's blindness.

Don't try to correct eye trouble with glasses from a store counter. An early warning of possible glaucoma is the frequent need to change the strength of glasses. Also, need for stronger reading glasses than is normal for your age might be another warning—of glaucoma or other ailments. Yet if you select readymade glasses, you

are not seeing a doctor who would pick up either of these cues for careful professional diagnosis of your eyes.

A problem with vision could be due to diabetes, kidney trouble, high blood pressure, or other bodily ailments which affect eyesight and require a physician's care.

How do cataract and glaucoma differ?

Clouding of the eye lens is the cause of faulty vision in cataract. When Mr. Larkin's transparent lens turned opaque, the image of objects couldn't be formed on the retina inside the back of his eye. In advanced cataract, the whitened lens can be seen where the black pupil or opening in the colored iris normally appears. Usually an eye surgeon can remove the chalky lens and restore both reading and distance vision.

Damage to the optic nerve is the cause of faulty vision in glaucoma. In Mr. Page's eye, increased eye pressure, medically called increased intraocular pressure, threatened to strangle his eye nerve (optic nerve) and the blood vessels which nourish it. A block in normal eye drainage is the usual cause of such increased pressure.

Only by his doctor's painless measurement of eye pressure with a tonometer could Mr. Page's increased eye pressure be discovered before he noticed any symptoms. By the time glaucoma causes difficulties noticeable to the individual, vision loss has begun. Even at this point, glaucoma treatment with medicine or surgery usually can control eye pressure and prevent further loss of eyesight.

Are cataract and glaucoma related?

In rare cases, cataract and glaucoma could cause each other. For example, Mr. Larkin's eye lens enlarged during formation of his cataract, pressed forward on the fluid in the front chamber of his eye, and threatened him with glaucoma. On the contrary, if untreated the

increased eye pressure in the last stage of Mr. Page's glaucoma would have produced cataract. The double disaster confronting Mr. Larkin and Mr. Page was warded off by early care by an ophthalmologist and faithful cooperation by the patients.

In addition, increasing age is a key factor in both cataract and glaucoma. Everyone's eye lenses start a gradual solidifying as early as age 25, and a few people have serious cataract in early years. Anyone who lives to be 70 or 80 has at least a mild degree of cloudy lens or cataract. For unknown reasons, the increased eye pressure which is the main symptom of glaucoma is commonest after age 35.

Fortunately, eye surgeons have improved their combined operations for cataract and glaucoma, and report many successes.

Eye drops—truths and fallacies

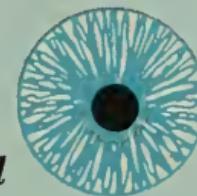
Trading personal experiences with eye ailments is a favorite but dangerous pastime. "The doctor checked my eyes with eye drops." . . . "I'm having drops for glaucoma." . . . "I'm having drops for cataract." . . . "How could you? My doctor told me no drops can cure cataract!"

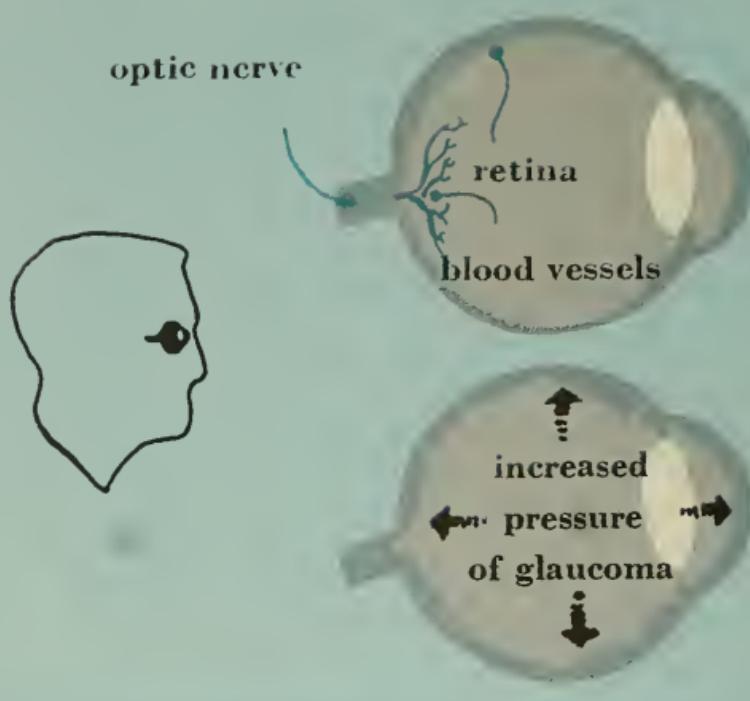
The truth is that there are drops—and drops. Two kinds work in opposite directions on the iris or colored part of the eye which opens and closes like the diaphragm of a camera to let in more or less light.

*pupil
dilated*



*and
contracted*



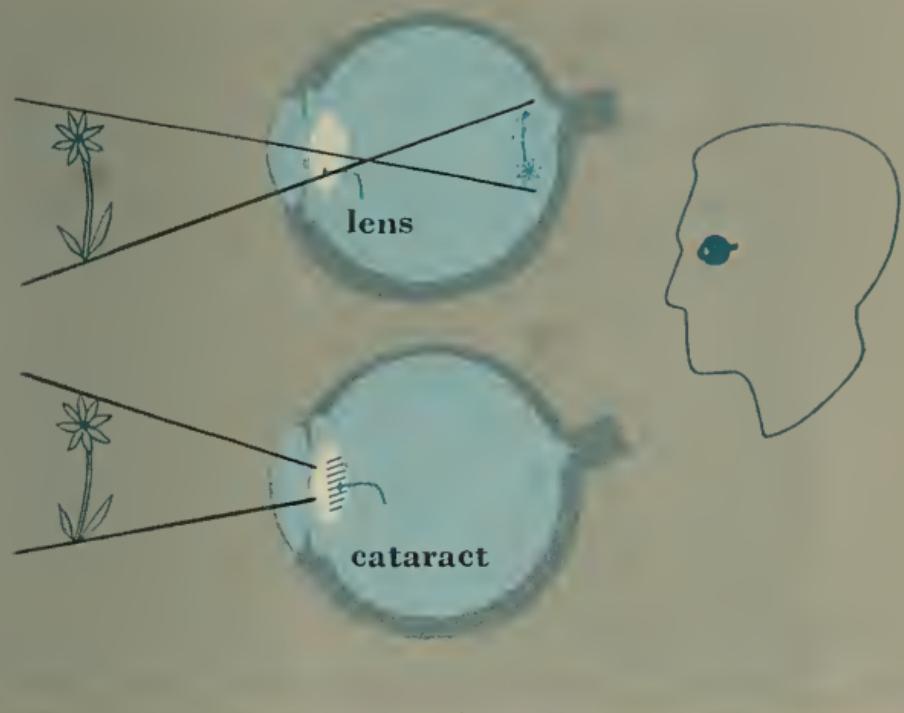


The eye drops an ophthalmologist puts (instills) into the eye to enlarge (dilate) the pupil are medically a mydriatic. The pupil is an actual opening in the center of the colored iris, which is protected by the transparent cornea, slightly in front of the iris and pupil. Like the dentist who says, "Open wider, please," the eye specialist who needs a better look inside the eye makes the pupil larger with these mydriatic drops. These drops relax the muscle which controls the lens shape and allow the doctor to distinguish farsightedness and to discover what a child has been covering by straining. In this way, use of drops reveals faulty eyesight not detected under normal conditions.

The opposite effect on the iris is caused by miotics, which make the pupil tiny.

Several kinds of eye drops are being prescribed by ophthalmologists as one of the treatments of glaucoma. Such drops may lower the damaging high internal eye pressure of glaucoma and must be prescribed individually for each patient.

In cataract, drops to dilate the pupil are occasionally prescribed. The explanation is simple. Occasionally cataracts cloud first in the center of the lens, while the outer rim of the lens remains



clear. If the pupil is widened with weak dilating drops, more vision is possible through this transparent outer rim of the lens.

No honest person pretends that a central cataract is being "cured" because vision improves when the dilated pupil permits sight through the outer part of the lens. But the temptation exists for the quack. If a "drop" ever is discovered to restore a clouded cataract lens to transparency, all doctors will learn of this promptly.

A medicine was discovered recently which loosens the attachment of the lens to make surgical removal of an opaque lens easier in some cases. This brought a flood of mail. People mistakenly hoped this medicine could cure cataract without surgery.

More about drops—and their use

Still other eye drops are used to anesthetize the eye briefly to make the tonometer test for glaucoma painless.

Antiseptic drops are prescribed for infections, and at times to lessen the danger of a well eye getting infected from a sick eye. Plain tap water should be used to flood the eye as first aid treat-



ment if anything splashes into the eye. Anything stronger should be prescribed by a doctor.

The extreme risk of using "drops" from an advertisement or a friend should be plain from this explanation of the different kinds. Don't risk your irreplaceable eyesight with self-doctoring of any kind!

If your doctor prescribes drops, you will be wise to ask him how he wants them put in. Practice in front of him until you do it correctly. Better wash your hands before instilling drops: 2 minutes for cleanliness is more sensible than 2 weeks for fighting infection.

Cataract

What cataract is and is not

According to a careful estimate, cataract causes almost one-fourth of the blindness in America. Much of this blindness could be avoided by using information available today.

Cataract is not a tumor; cataract is not contagious.

If you define cataract as opaqueness in the lens of the eye, everyone has cataract because no one has a lens as clear as a windowpane. More practically, cataract is cloudiness of the lens which interferes with normal vision.

Cataract is not a film growing over the lens, but a change in the lens itself. If you think of a normal lens as resembling a raw egg white, which you can see through, then a cataract is like a cooked egg white, which you can't see through. Or, you could compare a normal lens to water, and a chalk-colored cataract lens to snow. Cataract is any cloudiness of the lens which blocks the normal passage of light rays through the pupil to the retina—the light-sensitive tissue in the back of the eye.

What are the symptoms of cataract?

Early symptoms of cataract may be blurring of near and distant vision. To Mrs. Brown, an object appears as if a chunk were missing. Mrs. McKee is troubled by a black spot in front of her eyes which moves whenever her eyes move. To Mr. Wagner, lights appear double.

Symptoms depend upon the location of the cloudiness in the lens. If the outer rim of your lens becomes cloudy and the center is clear, you may be able to read a wall chart with a 20/20 vision rating, in spite of your cataract.

You must see an eye specialist for an early diagnosis of cataract. Don't repeat the error of the centuries and confuse glaucoma and cataract.

Oddly enough, reading sometimes becomes easier for the person who has a beginning cataract. His lens grows plumper, more convex, so that he boasts of the "second sight" of the elderly and throws away his reading glasses. But his vision for distance grows poorer. He needs to see an ophthalmologist who can advise him of the wisest time for a cataract operation.

Causes of cataract

Among the known causes of cataract developing in once-normal eyes are injury, general diseases such as diabetes, or neglected glaucoma of the eyes. Children may be born with cataract from hereditary influences or because their mother had German measles during the first 3 months of her pregnancy.

Cataract is not caused or hastened by using the eyes for reading, sewing, TV, or movies.

About two-thirds of the blindness from cataract is of the over-55-years type, for which no cause has been proved. This has been called the senile type—an unfortunate term because it implies helplessness. More and more people are living long enough to have "senile" cataract. But they are well and independent before and after their cataract operation.

Cataract will continue to increase because more lives are saved from early death from infectious diseases. The increase of cataract is expected to continue until research finds some way to prevent the older-age type of cataract.

Animals can be given cataract through excessive exposure to X-rays, by diets lacking essential proteins, or by being fed certain toxic chemicals.

Prevention and treatment of cataract

The known prevention of cataract is general: Avoid injuries to the eye; wear safety goggles in

plants where advised; if working around radioactive materials, observe all protections known.

Have regular medical examinations, and keep diabetes under medical supervision. Have regular eye examinations at least every 2 years after age 35, including a tonometer reading of eye pressure.

Women in the early stages of pregnancy should try to avoid exposure to persons with infectious diseases, particularly anyone who seems to be coming down with German measles (rubella). A pregnant woman should tell her doctor immediately if she is exposed to German measles or thinks she is getting it, as her doctor might want to consider an injection of protective gamma globulin.

About 98 percent of cataract can be cured by surgery. Most cataracts are progressive and will require an operation if the person lives long enough. Some cataracts are stationary, and never need surgery.

Two generations ago, cataract was a dreaded diagnosis. Today, the diagnosis of cataract means surgery at the proper time and a brief hospital stay. After the cloudy lens is removed, its function is replaced by wearing eyeglasses or contact lenses. Good vision can be expected if the eye nerve is healthy.

The ancient cataract operation

The ancient operation of "needling" or "couching" for cataract probably originated in India where it was described in detail in 1000 B.C. From India it did not spread to the Eastern Mediterranean until six centuries later. Using a needle, the operator poked the whitish obstruction behind the iris loose from its supporting fibers, allowing it to drop down in the back of the eye. Not until early in the 18th century was it proved by autopsy that the cataract pushed away from the pupil was actually the lens of the eye.

Yet the old operation could be successful, because it again allowed light to enter the eye,

reach the optic nerve, and be interpreted by the brain as objects seen. However, complications after this old-type operation endangered the vision later. Today a different operation called "needling" is sometimes used for children's cataracts.

The modern cataract operation

Today the eye surgeon usually removes the clouded lens entirely from the patient's eye. This cataract extraction has recently been made easier in some cases by the use of an enzyme with the long name of alpha-chymotrypsin. This chemical weakens the ligament holding the lens so that the lens is more easily tumbled out.

Another modern improvement helps to restore two-eyed (binocular) vision to the person who has had surgery for cataract of only one eye. An eye from which the lens is removed sees an image of a different size from an unoperated eye. But the addition of a contact lens replaces the function of the cloudy lens which was removed.

Also, patients no longer have a long wait for a cataract to "ripen" although special reasons could exist for postponing cataract surgery. An ophthalmologist usually advises cataract operation as soon as a cataract interferes with whatever is the normal use of eyesight of a particular patient.

On the contrary, if you put off cataract surgery you run the danger of an "overripe" cataract which is difficult to remove successfully. "Hyper-mature" is the medical name for an overripe cataract. Delay could be folly if you need an operation.

Don't let an old-fashioned fright about surgery drive you into the hands of quacks. They ask large cash sums to "cure" cataract with mysterious drops or exercise, or electric gadgets, or "home surgery." A quack has been known to show a dried split pea and claim this was a cataract lens he had removed from his victim.



Preparing animal lenses for cataract study

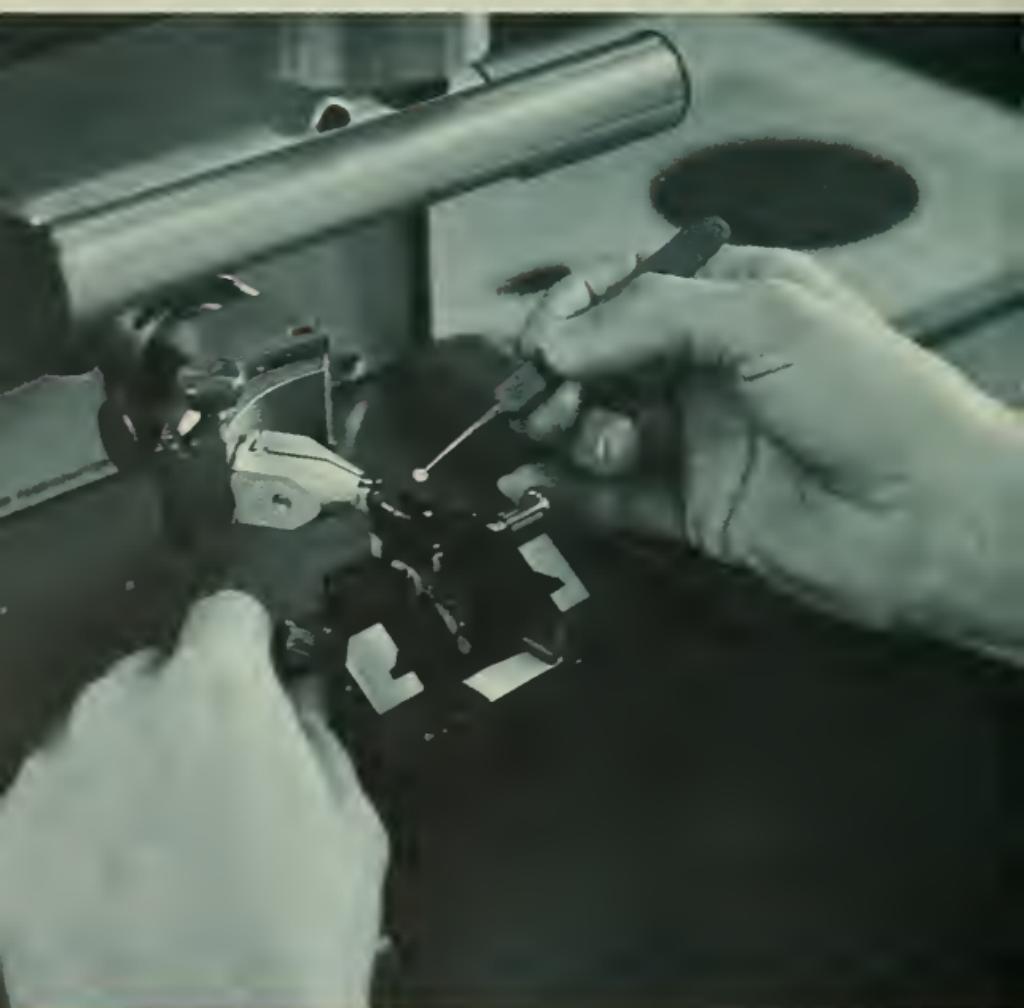
Research—the hope for cataract

Laboratory researchers use test tubes and animals to seek the answers to "why, how, and when" the normally clear lens of the eye clouds up, and what can be done about it. The National Institute of Neurological Diseases and Blindness (NINDB) conducts a vigorous research program in eye disorders at its Bethesda, Md., laboratories. As one of the National Institutes of Health, NINDB also awards grants for eye research to non-Governmental institutions.

At the Institutes, scientists are restudying the human eye with the electron microscope. Enlargement of the view of tissue is theoretically unlimited with this instrument. Practically, the electron microscope today magnifies 100 times as strongly as the older light microscope.

The delicate human lens is a most difficult tissue to handle for microscopic study, but progress at the Institute is impressive. Already a finding by electron microscope has shown the damage occurring in a part of the cell within 1 day after exposure of an animal eye to X-rays; the light microscope did not detect this type of eye cell damage at this time.

Great difficulty also surrounds the research on tissue culture of the lens—growing lens in a test tube—because lens cells are much more fussy in their food requirements than many other body cells.



Slicing lens for microscopic study

Medical centers, through such Institute grants or other support, are working on many eye problems. The voluntary associations, supported by donations, also pursue or support eye research.

Part of the research money is supporting training for many kinds of specialists in eye research. A lack of prepared scientists has delayed the research program but this situation is improving as men and women complete their training for research.

By radioactive tracer methods, a scientist followed nourishment from the blood into the eye to observe how the eye uses it. In another study on lens nourishment, an Institute investigation with rabbit lenses showed that the ability of the lens to use food substances (metabolism) was more efficient in young rabbits than in old ones. From such studies about metabolism, scientists are trying to discover what goes wrong when a lens turns milky colored with cataract, and what nourishment helps keep a lens clear and normal.

Another study with rabbits was done abroad. Foreign researchers have been able to regrow a new eye lens in rabbits, after removing the normal lens by surgery like a cataract operation. They injected lens tissue from an unborn rabbit into the emptied lens capsule and regrew an apparently normal lens. As yet, no comparable operation for human beings appears practical.

All this is called basic research, involved with biochemistry and cytochemistry, electronmicroscopy, and immunology. It looks for background facts. Such basic research will benefit human eyes if in the future scientists learn how to keep an eye lens clear, or to help it regain clearness, or to regrow a human lens.

Research with cataract patients

In clinical research, studies may deal exclusively with people or with both people and animals.

The path may shuttle back and forth between clinical and basic research. Even after the chemical called alpha-chymotrypsin was being em-

ployed for human surgery on cataract, research continued with both humans and animals. An Institute scientist tested the chemical in rabbit eyes, noted the microscopic change it caused in tissue cells, and observed their rapid recovery. This was a further check on the safety of using this chemical which makes the cataract operation easier.

The search for causes of blindness in children takes a tremendous impetus from a nationwide study of about 60,000 women and their babies. This pioneering study is supported by grants from the Institute to 14 collaborating medical centers and universities, and is directed and co-ordinated at the Institute. A family and personal history of parents and many scientific observations during pregnancy, delivery, and early infancy—the perinatal period—for the first time will provide information unbiased by knowledge that blindness has occurred. New causes of childhood blindness may be uncovered, and methods of treatment and prevention of blindness developed.

Glaucoma

Sharp contrasts mark glaucoma

Sharp contrasts between forms of glaucoma add to the problems of this disease in which increased eye pressure crushes the nerves of sight.

Mr. Page's glaucoma stole upon him like a silent thief, without a single warning. Except for that fortunate checkup and a tonometer test for eye pressure, Mr. Page's glaucoma would not have been discovered before his vision was damaged. Several community screening projects for glaucoma are seeking the person over 35 who hasn't had such a checkup on his own initiative.

A person can read a wall chart with 20/20 central vision and still be blind around the edges of his eye field. He can have glaucoma for months or years before he notices any difficulties; chronic glaucoma is a lazy thief.

But Mr. Page's neighbor, Mrs. Richardson, without warning had one of the most agonizing pains known to humanity—acute glaucoma. Her eyeballs turned stony hard. Her physician rushed her to a hospital for an operation by an ophthalmologist. Surgery for acute glaucoma must be performed promptly, at least within 24 to 48 hours, to prevent blindness from strangled eye nerves.

No one symptom you could notice would mean you had glaucoma. But several are a warning for an immediate tonometer test. They include vague and changeable headache or eye aches perhaps after seeing movies or TV in the dark; any fuzzy or blurred vision which comes and goes; watering or discharge of the eye; poor vision in dim light; any change in eye color; seeing rainbow halos around lights; any loss of side vision (which will grow worse and cannot be restored).



*National Institutes of
Health (NIH) as seen
with normal vision*

Another warning is family history of glaucoma. Relatives of those with glaucoma have five or six times as much of this eye ailment as persons without glaucoma in the family. Advise all relatives, especially brothers, sisters, and any offspring over age 25, to have a complete eye examination if you have glaucoma.

Glaucoma is not cataract, is not contagious, is not cancer, is not caused by high blood pressure. However, among people over 35, those with high blood pressure, heart ailments, or diabetes have more glaucoma than others. Glaucoma occasionally affects children and younger adults.

Glaucoma is more truly a symptom than a disease. The basic symptom is the increased eye pressure which crushes the eye nerve. Some in-

*NIH as seen by
patient with advanced
glaucoma*



vestigators believe glaucoma could be a general body disease of which the eye symptoms are the only ones yet discovered. Research may tell eventually whether this is true.

Mr. Page's chronic glaucoma can be controlled by special eye drops three times a day, perhaps combined with a medicine taken by mouth. But his farmer cousin, Jack Townsend, is about to have surgery for chronic glaucoma (glaucoma runs in their family). Jack couldn't make himself go to town regularly for a tonometer (eye pressure) reading; he couldn't be bothered with daily eye drops.

After a couple of flare-ups of eye pressure, Jack's doctor warned him, "For you, the only safe preventive of blindness is an operation for glaucoma. I'm sorry, because I hoped you would get along on a medical program."

Of course, even people who are always faithful with their medical care of chronic glaucoma might need glaucoma surgery.

Ominous figures about glaucoma

An estimated million Americans over 35 years of age have glaucoma and don't know it! In every large survey of such persons, two out of a hundred are discovered with chronic glaucoma. In homes for the elderly, surveys uncover about six in a hundred with previously undiscovered glaucoma.

Every year about 4,000 more people in the United States GO BLIND from glaucoma which could have been controlled by early discovery and faithful treatment.

Glaucoma ranks second to cataract as a cause of blindness in the United States and accounts for 14 or 15 percent of the blind. About one blind person in seven is needlessly blind from glaucoma.

Kinds of treatment for glaucoma

A patient with glaucoma finds it easy to carry out his doctor's orders. His doctor plans and directs the treatment which usually includes one or more of these common goals:

Unblock with special eye drops the drainage system of the eye which dams back the outflow of eye fluid.

Decrease with medicine by mouth or eye drops the inflow of fluid into the eye.

If the drainage system can't be unblocked, consider a new drainage outlet with surgery.

The task of controlling glaucoma usually requires several trips to your ophthalmologist until your eye pressure comes down and stays down;

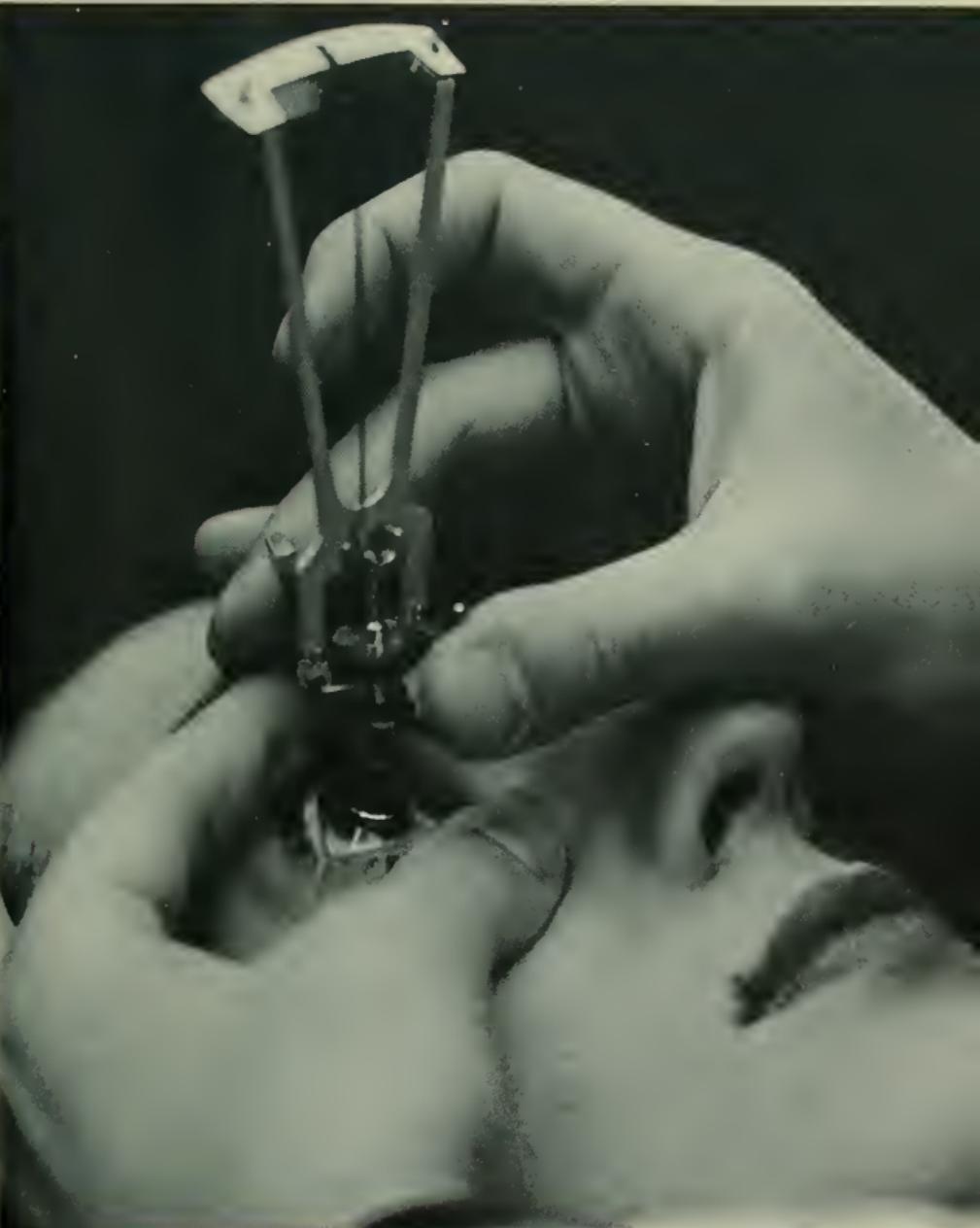
then regular checkups with a tonometer and medical advice the rest of your life.

Don'ts and do's for glaucoma patients

Don't forget your eye drops when busy, on trips, or sick. Just as the diabetic who forgets his insulin can become unconscious, so the glaucoma patient who forgets his drops can become blind.

Don't be afraid to read.

A few glaucoma patients should not see double feature movies or view TV in a dark room—



Quick and painless tonometer test

other lights should be kept on. Because emotional upsets appear to trigger glaucoma or make it worse for some people, a calm life is worth cultivating. Ask your eye specialist's advice about using coffee, tea, alcoholic beverages, or tobacco.

Don't drink large quantities of water or other liquids at one time. Tests prove this can increase eye pressure.

Tell your family physician you have glaucoma. Before any kind of surgery, be sure the surgeon knows you have glaucoma. Better let your ophthalmologist know about any suggestions for any kind of surgery.

Don't forget your annual physical and dental checkups.

More about tonometers to measure eye pressure

One exception to the necessity for measuring eye pressure with a tonometer is recognized. A person like Mrs. Richardson having the excruciating pain of acute glaucoma does not need a tonometer reading. The immediate need for surgery to relieve such a stony hard eye is obvious.

With this exception, all other persons must have a reading with a tonometer to determine their eye pressure (intraocular pressure or IOP or intraocular tension). The old method of pressing lightly on the closed eyelids revealed a difference in pressure if only one eye had glaucoma, or hardness in both eyeballs in advanced glaucoma. This finger pressure test does not detect early glaucoma and could be compared to estimating fever by laying your hands on the sick person instead of using a thermometer.

In 1881, a Norwegian physician, Hjalmar Schiøtz, invented an eye tonometer to measure eye pressure. Today's Schiotz tonometer is the most widely used instrument for early detection of glaucoma.

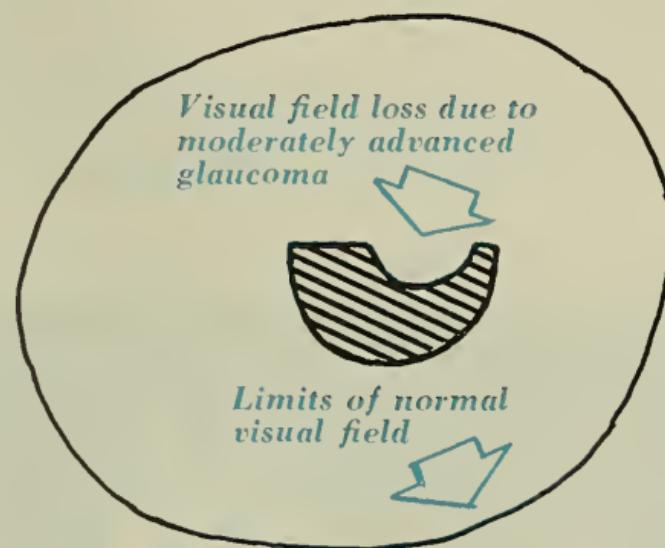
When a physician performs this painless, 5-minute test, he first drops a local anesthetic in each of your eyes. He asks you to sit in a chair with your head tipped back or to lie down. He

carefully places the tonometer on each of your eyeballs in turn, because the pressure often differs in right and left eyes.

A movable weight weighing less than one-fifth of an ounce or about the weight of two dimes indents your eyeball slightly. A little pointer moves along a scale to give the physician the reading of your eye pressure. Your pressure is recorded as millimeters of mercury and this record over the months and years becomes the guide to treatment to prevent blindness.

In doubtful cases of glaucoma, your eye doctor asks you to drink a quart of water in a short time, then remeasures your pressure to see whether your eyes can handle extra liquids without dangerous increase in eye pressure.

Since improvement in 1955 in another device for measuring pressure, the applanation tonometer, certain advantages account for its increasing

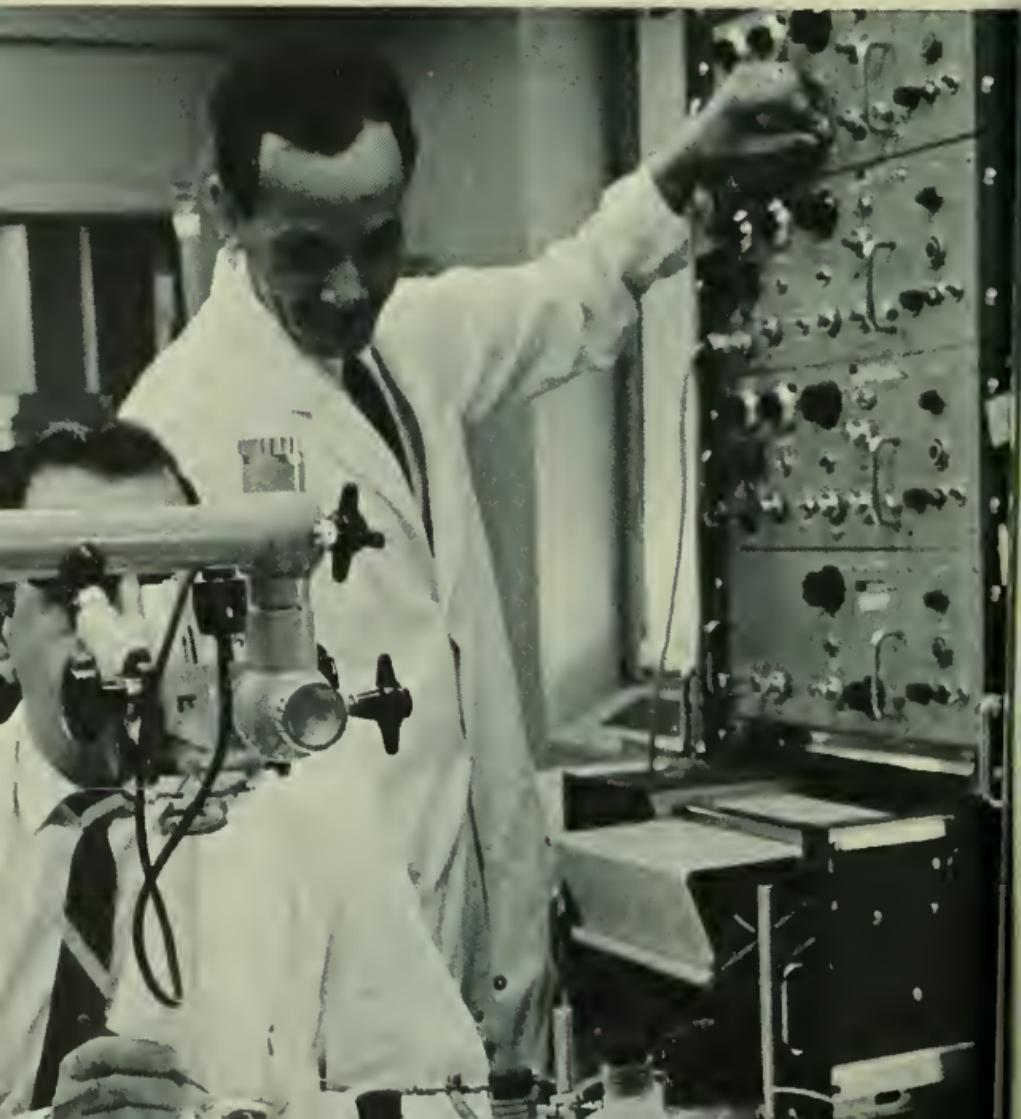


*Checking the
field of vision*

popularity in eye clinics. The painless applanation tonometer test also requires a drop of local anesthetic and a few minutes' time. In extremely nearsighted persons and other special cases, applanation tonometry may be more reliable than Schiotz tonometry.

Eye specialists know there aren't enough ophthalmologists to perform tonometer tests on everyone over 35 years. They are urging family doctors to learn how to use a tonometer and to make a tonometer eye pressure test as standard in physical examinations as the now commonplace blood pressure test. For the big community glaucoma screening campaigns, medical technicians are taught to make tonometer tests, but ophthalmologists interpret the records and prescribe the treatment for glaucoma.

The charge for a tonometer test by a private doctor is usually the same as for any office visit. If your doctor is checking your eyes for glasses, he probably includes a tonometer reading. Persons who cannot afford private eye care can find assistance without cost by asking a public health nurse, social worker, health department, or a local



branch of one of the voluntary associations for eye ailments.

Another test for glaucoma is tonography. An electric tonometer connected with a recording device is placed on the eye for perhaps 4 minutes. Instead of the single reading with a tonometer, a continuous reading is made which helps to measure the ease of outflow of the liquid (aqueous humor) which is causing the increased eye pressure. This outflow record assists in diagnosis of doubtful cases of glaucoma and helps the eye specialist watch cases under treatment. Information on a decrease in ease of outflow could warn of the need for glaucoma surgery to save eyesight.

It is perfectly true that glaucoma can be discovered without tonometry by measuring the permanent loss of side vision of an afflicted person. But this is a tragically unnecessary way to discover an ailment which can be diagnosed quickly and painlessly before partial blindness occurs.

Research—the hope for glaucoma

People threatened with blindness may be comforted to know that quite a few research scientists are devoting their time to unraveling the cloak of mystery surrounding glaucoma.

Research at the National Institute of Neurological Diseases and Blindness in Bethesda, Maryland, and at non-Government medical centers with the support of Institute grants seeks to find how to prevent glaucoma and how to improve treatment. Research supported by voluntary eye associations and other outside groups has similar goals.

At the Institute a scientist performed the extremely delicate procedure of injecting a radioopaque material into the tiny veins of a living animal to provide a photograph of the system of veins within the eye.

Institute scientists are studying the electric impulses of the eye nerves which respond to changes in intraocular eye pressure.

The medicine given humans by mouth to drop the inflow of eye fluid is being tested with cats to gather further information about the delicate balance of inflow and outflow in glaucoma.

These examples of basic research suggest how ophthalmologists, pharmacologists, and neurophysiologists work together to solve an eye problem.

But clinical research with humans involves quite as large an assortment of scientists. The basic scientists work closely with the clinicians. In addition, the medical and surgical eye specialists, the pharmacologists who work with medicines and their effects, and epidemiologists who study glaucoma as it affects numbers of people are involved in this inspiring ambition to save people from blindness.

An example of research in eye surgery for glaucoma, developed elsewhere to prevent blindness, involves the rare cases of glaucoma in the newborn or young infants. Affected children usually have large eyeballs and corneas, and unusual sensitiveness to light. Early surgery may prevent blindness.

Clinical investigation at the Institute includes the admission of glaucoma patients in order to make repeated tonometer tests and other examinations. Research patients with glaucoma know they will be given many more examinations than are usual for treating patients in an ophthalmologist's office. Everyone's eye pressure fluctuates, usually in a smooth curve repeated every 24 hours, usually highest in the morning. But the daily curve is often different in glaucoma patients, and the peak could come in the afternoon.

A continuing study of methods for screening and diagnosis of glaucoma was launched toward the end of 1959. Financial support comes from the Neurological and Sensory Disease Control Program of the Department of Health, Education, and Welfare. Practical means for early and accurate detection of glaucoma are the goal, and new techniques or improvement of present techniques are sought.

Where you can find help

A family doctor or an optometrist can refer patients to an ophthalmologist to confirm a diagnosis and manage the treatment of glaucoma or cataract. For further information you may write to any of these voluntary associations:

The American Foundation for the Blind, Inc., at 15 West 16th Street, New York, N.Y. 10011, as part of its educational program has an extensive information service, including helpful pamphlets and reports.

The "Fight for Sight"—the National Council to Combat Blindness, Inc., 41 West 57th Street, New York, N.Y. 10019, founded in 1946, awards grants-in-aid and fellowships in ophthalmic research, both basic and clinical, at medical colleges and eye centers here and abroad. Post-doctoral fellowships enable qualified scientists to engage in full-time research or training. Under-graduate fellowships encourage students of medicine and the basic sciences to embark on careers in ophthalmology and, particularly, ophthalmic research.

The National Society for the Prevention of Blindness, Inc., 79 Madison Avenue, New York, N.Y. 10016, emphasizes the prevention of blindness through a program of lay and professional education by publication of *The Sight-Saving Review* and many helpful leaflets and films. It also emphasizes community glaucoma detection; preschool and school vision testing programs; school and industrial eye safety programs; and statistical studies and research in blinding eye diseases and defects.

Research to Prevent Blindness, Inc. (RPB), 598 Madison Ave., New York, N.Y. 10022, seeks the preservation of sight through programs to intensify and accelerate scientific research into the causes, prevention, and cure of blinding diseases. It has awarded prizes and provided grants for eye research, financed construction campaigns for new eye research centers, and established RPB Eye Research Professorships and Manpower

Awards to attract researchers. RPB also conducts bi-annual National Science Writers Seminars in Ophthalmology to inform the public on eye research progress.

Many local groups such as the Lions Clubs, the Knights Templar, the Delta Gamma's, and others, have been extremely active in helping people and their families with eye problems. They have arranged for examinations and hospitalization.

Your city, county, or State health department has information to help persons and their families with eye problems.

The Federal Government has several programs dedicated to saving your sight or helping persons who are blind or partially blind. Among programs in the Department of Health, Education, and Welfare:

The Department conducts and supports research in blindness—primarily through its National Institute of Neurological Diseases and Blindness—and assists States to develop glaucoma detection and other programs for the prevention of blindness.

The Rehabilitation Services Administration extends financial support to agencies serving the blind and visually handicapped in all States. The primary objective is to return such persons to the independence of self-support.

The Social Security Administration has two programs which primarily provide an income to the eligible blind and severely visually handicapped. One comes under the Old-Age, Survivors and Disability insurance program for eligible persons. The other provides Federal funds to assist State welfare departments in support of Aid to the Blind programs.

The Children's Bureau of the Social and Rehabilitation Service provides some financial support to State crippled children's agencies for care for certain children with congenital cataracts or other blindness.

The Office of Education collects and disseminates information on the education of visually handicapped children and youths.

Other Government agencies can help you:

At the Library of Congress, the chief activity of the Division for the Blind and Physically Handicapped is to provide reading materials for persons who can no longer read in the regular manner. Books on magnetic tape, in braille, or on records, and record players are provided to all those who need them, free of charge.

The Veterans Administration has programs for blinded or partially blinded veterans, and screening research programs at VA hospitals and clinics for location of glaucoma and other eye ailments.

Surprisingly, people are not making the most of the many sources dedicated to preserving eyesight. If you have an eye problem, don't hesitate to ask any of these sources for help. Remember that professional diagnosis and treatment coupled with faithful cooperation by patients does save vision!



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